A TRIAL COMPARING TWO DIFFERENT METHODS OF FEEDING JEJUNOSTOMY

A dissertation submitted to the DR. MGR Medical University, Tamilnadu in partial fulfillment of the requirement for the M.S Degree (Branch I – General Surgery) examination to be held in February 2007.

CERTIFICATE

This is to certify that this Dissertation "**A trial comparing two different methods of feeding jejunostomy**" is a bonafide work done by Dr. Job. N in partial fulfillment of M.S Degree (Branch I – General Surgery) Examination of the The Tamilnadu DR. MGR Medical University to be held in February 2007.

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INTRODUCTION

Enteral tube feeding is a valuable treatment modality in the management of both acute and chronic malnutrition. Recent advances in access devices, feeds and pumps have made enteral feeding a viable option for surgical patients.

Nasoenteral feeding tubes avoid the risk of peritonitis as the placement of these tubes do not require an enterotomy. However they are easily displaced proximally or even completely displaced during vomiting or retching. While replacements can be done with radiological confirmation, 20% require more than one attempt and there is increased risk of the tube breaching a recent anastomosis. By contrast, a jejunostomy feeding tube is inserted under direct vision downstream to the most distal anastomosis and is not susceptible to postoperative displacement by vomiting. From the surgeon's perspective this is a good way to deliver the maximum calories with the least procedure related morbidity and mortality.

AIM

A trial to assess effectiveness and complication rates of two different methods of feeding jejunostomy (Foley's catheter versus t – tube**).**

OBJECTIVES

To study our experience regarding the effectiveness, postoperative complication rates and the final outcome between two different methods of feeding jejunostomy done in Department of General Surgery Unit IV and Unit III from July 2004 to July 2006.

MATERIALS AND METHODS

All patients undergoing major upper gastrointestinal operations including pancreatic, biliary and liver resections in Department of General Surgery Unit IV and Unit III were included in the study. Patients undergoing feeding jejunostomy as a palliative procedure or with unsuitable omentum (see later) were excluded from the study. The patients were allotted into two groups prior to surgery. One group received a standard Stamm's feeding jejunostomy and the other group received t-tube feeding jejunostomy.

Standard isocaloric enteral feed (1048 kcal and 40 g protein per litre) was infused into the jejunal feeding tube. Energy and fluid requirements were calculated according to individual patient needs taking into account total body weight. Infusion of feed commenced at 500ml of half strength feeds on day one and increased every day until the calculated target volume was reached (35 ml/kg body weight/day – e.g. for a 70 kg patient =2000–2500 kcal and 80–85 g of protein per day). Intravenous crystalloids were reduced proportionally as the enteral feeding was increased and discontinued once the target rate of enteral feeding was achieved. The aim was to maintain this rate until oral intake was established. Oral intake was established as soon as patient recovered and tolerated feeds. Enteral feeding was discontinued when a free oral fluid intake had been achieved, usually by the end of day 6 or 7.

The outcome was defined as successful if jejunostomy was used for enteral nutrition after surgery and discontinued when patients achieved adequate oral nutrition or were discharged home on supplementary jejunal feeding.

Patient details were entered in a proforma and then transferred on to a Microsoft Excel spread sheet. Data entry and analysis were done using SPSS 13.

The complications were divided into major and minor complications. Major complications included leak into peritoneal cavity, tube dislodgement (migration of tube outside the jejunal lumen), jejunal perforation, entero-cutaneous fistula, abscess (intra abdominal or abdominal wall) and small bowel gangrene. Minor complications included tube block, tube detachment, (i.e. from anterior abdominal wall anchoring site) peritubal leak and diarrhoea.

TECHNIQUE

In the standard feeding jejunostomy, we used the Stamm technique and the technique was standardized among the different surgeons. An 18Fr Foley's catheter was used and the enterotomy was done in the antimesenteric border of the jejunal loop distal to the last anastomosis and secured around the tube with 3-0 silk sutures. The loop was then anchored to anterior abdominal wall with interrupted 3-0 silk sutures

and the tube brought out through a separate stab incision lateral to the main wound and anchored with a linen stitch.

For the “Adelaide” technique a t – tube no 6 was prepared as for a bile duct exploration and inserted into the designated loop of jejunum and the enterotomy secured around the tube with 3-0 silk sutures. The t – tube was then passed through omentum at a convenient point and taken through the abdominal wall lateral to the main incision and secured with a drain stitch. No sutures were used to secure the loop to the anterior abdominal wall.

FOLLOW UP

Patients were followed up for their period of stay in the hospital and monitored for minor or major complications.

SAMPLE SIZE

It was proposed to have 150 patients in each arm of the study. This was calculated for 10% difference in the complication rates between the two groups with power of the study being 80.

LITERATURE REVIEW

Enteral nutrition is always the preferred route of feeding any patient, including those with cancer, provided the gastrointestinal tract is functional. This can be accomplished by using between-meal supplements, by inserting soft, comfortable nasogastric feeding tubes, or by inserting gastrostomy or jejunostomy feeding catheters. Infusing nutrients into the gastrointestinal tract (as opposed to intravenously) allows them to be processed and absorbed in a normal physiologic fashion.

There are several benefits of using the bowel lumen for nutrient delivery. The trophic effects of enteral feeding on the small bowel mucosa have been well described. The integrity of the mucosal lining is maintained and may provide an effective barrier to intraluminal enteric organisms that might otherwise be absorbed into the systemic circulation. Atrophic changes are seen in the intestinal epithelium after several days of bowel rest; this atrophy is not reversed by currently available total parenteral nutrition solutions. Newer enteral diets contain pharmacologic amounts of gut-specific nutrients such as glutamine, a conditionally essential amino acid that is required for intestinal function.

Jejunostomy is a surgical procedure by which a tube is placed in the lumen of the proximal jejunum primarily to provide nutrition and sometimes medications.

HISTORY

The first person to perform jejunostomy was Bush in 1858 in a patient with inoperable gastric cancer. In 1878 Surmay de Havre exposed the jejunum and introduced a tube for the purpose of feeding by means of an enterostomy. In 1891 Witzel described the well known technique for jejunostomy. In 1973 Delany introduced the needle catheter technique with a thin tube that before entering the intestinal lumen passed through a tunnel formed in the seromuscular space of the intestinal wall. [2]

INDICATIONS

1. The primary indication for a jejunostomy is as an additional surgical procedure in patients undergoing major operations of the upper digestive tract.

2. Major operations of liver, biliary tract, pancreas and

3. Patients in whom a complicated post operative recovery is expected following laparotomy.

As a sole procedure it is advised for

1. Patients with tumours of head and neck with feeding problems.

2. Patients with neurological and congenital illness.

3. Corrosive stricture oesophagus.

4. Patients with neurologic problems such as deficit in the state of consciousness or problems with deglutition or gastric motility and

6. Carcinoma of oesophagus and gastroesophageal junction [2]

RELATIVE CONTRAINDICATIONS

1. Intestinal obstruction

2. Ileus

3. High output small bowel fistula

4. High dose inotropic agents

5. Radiation induced mucositis and enterocolitis

6. Chronic inflammatory disease of the intestine (e.g., Crohn's disease)

7. Ascites

JUSTIFICATION

1. After major surgery and multi-systemic trauma the small intestine maintains its peristaltic and absorptive capacity which is not the case for stomach and colon.

2. If the oral route is contraindicated, jejunostomy is a good method for avoiding aspiration. Placing the feeding tube distal to the ligament of Treitz minimises the risk of gastroesophageal reflux and bronchial aspiration.

3. From the surgeon's point of view, advances in the jejunostomy technique have made it less traumatic, more functional and efficacious; it can be used for prolonged lengths of time.

4. The jejunostomy tubes are inserted under direct vision downstream to the most distal anastomosis and can be firmly secured in position. They are not susceptible to being displaced by postoperative vomiting or retching.

4. Enteral nutrition is cheaper than parenteral nutrition.[2]

NEEDLE CATHETER JEJUNOSTOMY

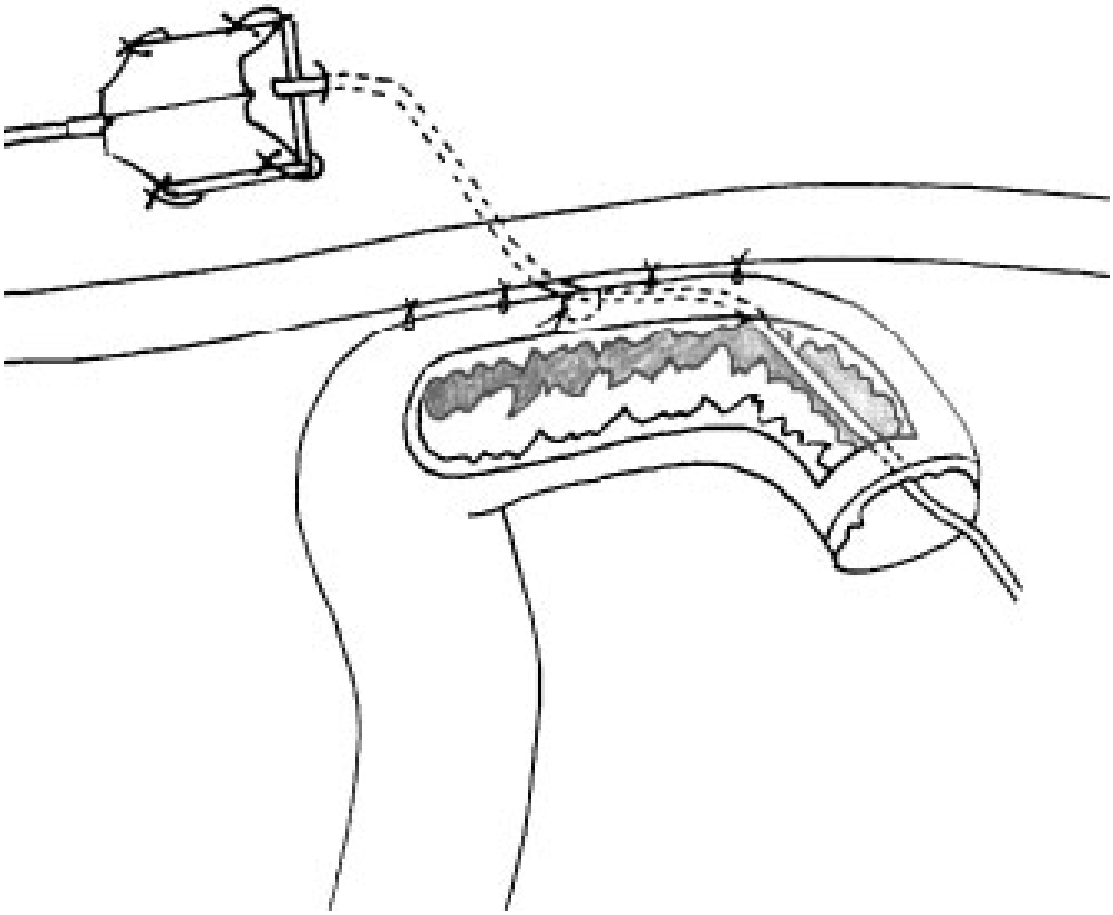
Needle catheter jejunostomy was first described in 1973. A 10 F feeding catheter is inserted through a cannula percutaneously in the left upper quadrant and inserted into the jejunum about 15–20 cm from duodenal-jejunal flexure through a purse string suture. The spot is subsequently buried with seromuscular sutures continued proximally to create a 5 cm long subserosal tunnel. The exit point of the catheter is then sutured onto the abdominal wall to protect against leakage.[3] (Fig No1)

Feeding is commenced on the first post-operative day using a nutritionally complete whole protein isotonic feed. The initial rate of administration is 30 ml/h for 8 h, 50 ml/h for 8 h and 80 ml/h for 4 h. On the second post-operative day, the infusion rate is increased to 100 ml/h for 20 h, with a 4-h rest period. The feeding goal is 2000 ml over 20 h. Aoife M. Ryan studied 205 consecutive patients who underwent oesophagectomy for malignancy who had needle catheter jejunostomy as part of the operation. The incidences of complications following needle catheter jejunostomy were [3]

Gastrointestinal complications	
Constipation	18%
Laxative requirement	26%
Diarrhoea >3/day	11%
Nausea	16%
Cramps	6%
Abdominal distension	4%
Vomiting	3%
Mechanical complications	
Tube dislodged	2.4%
Tube occlusion	3%
Infection at entry site	1.4%
Site oozing	1.4%
Bowel obstruction/ volvulus	1.4%
Mortality	0.5%

Figure No.1

Needle catheter jejunostomy after insertion



LAPAROSCOPIC FEEDING JEJUNOSTOMY

A 10 mm camera port is inserted at the umbilicus by open technique and two additional 5 mm ports are placed in the right upper quadrant and the left iliac fossa respectively. The duodenojejunal flexure is identified and a convenient point on the jejunum is marked out approximately 30 cm from the flexure. A 2.5 cm transverse incision is made in the left upper quadrant extending into subcutaneous tissues but not through the muscle. The wound edges are retracted and a suture on a 60 mm straight needle is passed through the abdominal wall into the peritoneal cavity. After taking a full-thickness bite into the jejunal wall, the needle is brought out through the incision onto the surface of the abdomen close to the insertion point. Two more sutures are placed using a similar technique to complete 3 points of a triangle with each side measuring 1 cm. Trocar and cannula of the feeding jejunostomy kit are passed into a jejunal loop after traversing the abdominal wall centering within the 3 sutures. (Photograph No.1) The trocar is removed and a feeding jejunostomy tube is passed via the cannula into the efferent limb. [4]

Photograph No.1

Cannula being inserted into jejunal loop

The tube is flushed with saline to check the position. Traction is placed on the stay sutures to approximate the jejunum onto the peritoneal surface of the abdominal wall. Sutures are tied within the subcutaneous space. The feeding tube is tunneled subcutaneously though the abdominal wall for 3 cm and then brought to the surface where it is secured using a flange provided with the device. The average time taken for placement of such a feeding jejunostomy tube is 15 minutes.

In a series of 18 patients who underwent laparoscopic feeding jejunostomy along with staging laparoscopies for carcinomas of the distal esophagus and oesophagogastric junction, the incidence of minor complication was 17% which included tube dislodgement, pericatheter leak and wound infection at the tube exit site. No major complications were reported.[4]

Photograph No.2

Jejunum loop is approximated onto the peritoneal surface of the abdominal wall.

T-TUBE JEJUNOSTOMY

An enterotomy is made in the antimesenteric border of the jejunum approximately 20 cm downstream from the most distal anastomosis. 14 Fr latex 't' tube is inserted and secured with a purse string suture. The tube is brought out through the anterior abdominal wall via a stab incision lateral to the main wound. The jejunostomy site is sutured to the peritoneal lining of the anterior abdominal wall so that the enterotomy site is excluded from the peritoneal cavity. The 't' tube is finally secured to the skin with silk sutures.[1]

Paul A. Thodiyil reviewed consecutive series of 36 patients who underwent various pancreatic operations along with feeding jejunostomy and the complication rates are given below.

COMPLICATIONS	NO OF PATIENTS
Feed related	20*
Diarrhoea	13
Abdominal distension	8
Nausea/vomiting	6
Abdominal pain	6

TUBE RELATED	8*
Peritonitis	1
Tube blockage	4
Tube dislodgement	2
Pericatheter leaks	2

* Some had more than one complication.

The use of a soft latex tube decreases the chance of jejunal perforation and latex 't' tubes encourage the early formation of fistulous tract permitting safe replacement in the event of dislodgement. Also the large caliber of the tubes minimises the risk of tube obstruction by feeds or by medications.[1]

WITZEL JEJUNOSTOMY

Witzel jejunostomy involves formation of a serosal tunnel. A loop of proximal jejunum 20 to 30 cm from the ligament of Treitz is delivered into the wound. A purse string suture is placed on the antimesenteric border of the bowel and an incision is made with electrocautery in the intestinal wall in the center of the purse string suture. A Foley's catheter 18 F is inserted into the lumen of the jejunum and advanced distally. The purse-string suture is secured in place, and a serosal tunnel is then constructed by placing 000 silk sutures from the

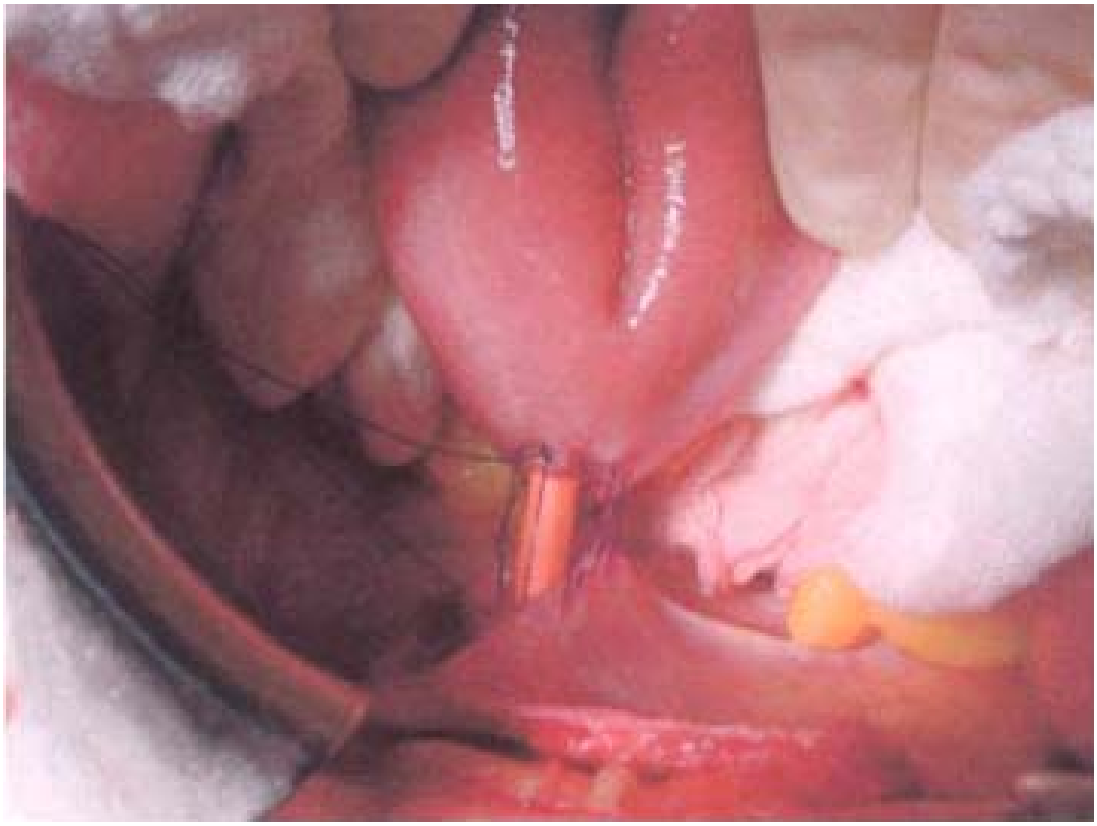
catheter's exit site extending 5 to 6 cm proximally. The catheter is then delivered through the abdominal wall through a separate stab incision. The adjacent loop of intestine is anchored with 000 silk sutures spread over 2 to 3 cm to prevent twisting of the loop and possible obstruction. The catheter is secured to the skin with a 3-0 nylon suture.

STAMM JEJUNOSTOMY

The jejunum is picked up at its origin and drawn out in a loop. At this point, a nick is made in the intestine at the antimesenteric border and a number 18 Foley's catheter passed about 4 inches down the intestine, fastening to the latter with a suture. The intestine is infolded about the tube for 1 cm with a suture of silk and is then fastened to the margin of the abdominal incision with two sutures.[6] (Photograph No.3)

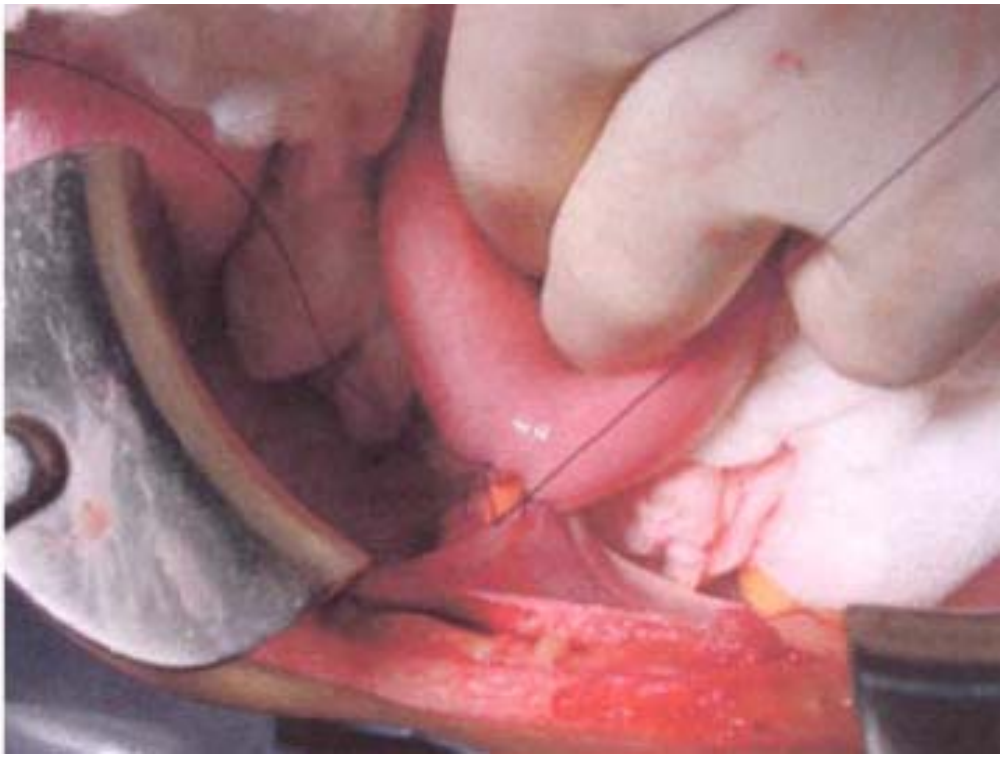
The tube is fixed to skin with sutures and tested for patency. This method is proof against leakage and closes at once when the tube is removed.

Photograph No.3



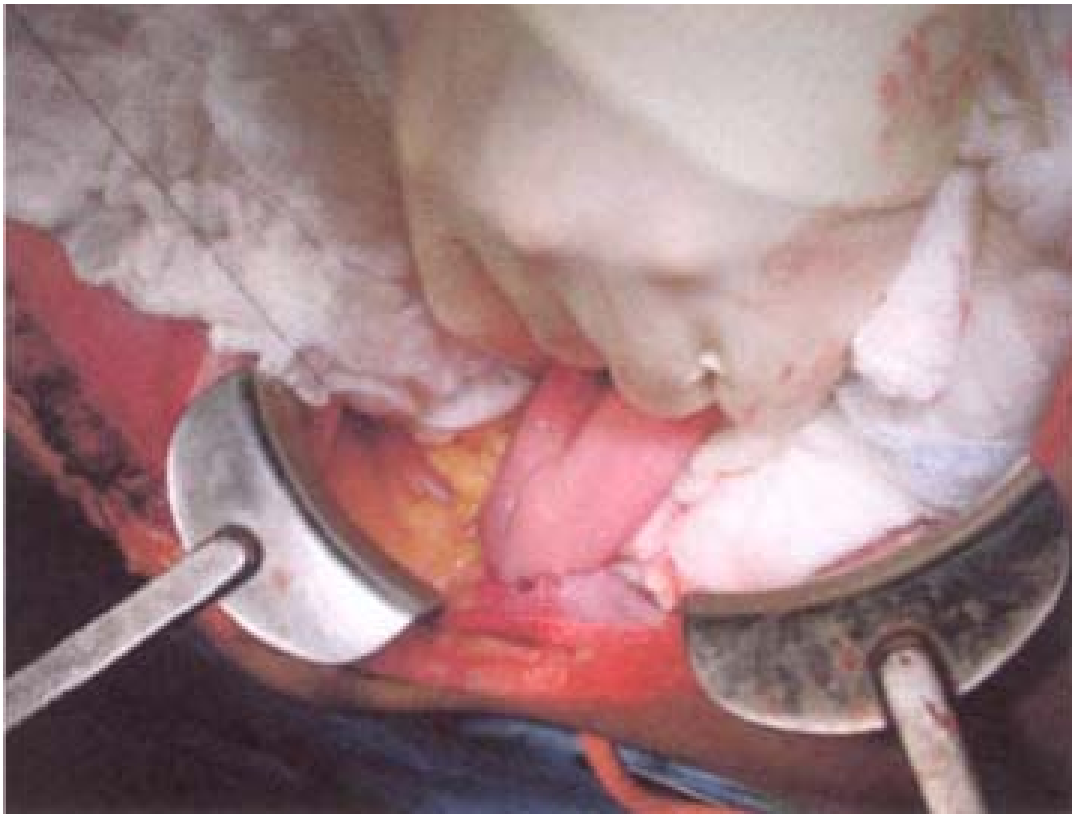
Jejunal loop being anchored to abdominal wall

Photograph No.4



Jejunal loop anchored to abdominal wall

Photograph No.5



Completed Stamm's jejunostomy

DIRECT PERCUTANEOUS ENDOSCOPIC JEJUNOSTOMY

The patient is sedated and a pediatric colonoscope is maneuvered into the efferent loop of the jejunum. The jejunal loop is transilluminated and maneuvered away from the midline laterally to the left side of the abdomen. A 22-G 1.25-inch needle is inserted at a distance of 1.5 inch from the midline and advanced in the direction of the jejunal loop. Penetration into the jejunal lumen is done and the needle is then grasped using a snare passed through the biopsy channel of the endoscope. The jejunal loop is secured to the anterior abdominal wall in this fashion to prevent migration of the loop. A 20-F percutaneous endoscopic gastrostomy kit is used for the procedure. The metal cannula is passed along the side of the needle in the same direction. The needle is released from the snare and removed. The cannula is then grasped with the snare. The stylet is removed and the guide wire inserted through the cannula into the jejunum. The wire is then grasped using the snare and pulled out of the mouth with the endoscope. The direct percutaneous endoscopic jejunostomy tube is placed using the standard push technique. A second-look endoscopy is performed to check the position of the internal bumper. The failure rate with this technique is 14% and can be minimised using an ultrasonogram to confirm the position of jejunal loop before entering the lumen. There is a 10% minor complication rate and a 2% major complication rate (bleeding of the stomach, perforation of the colon, and abscesses in the intestinal wall) associated with this procedure.[7]

COMPLICATIONS

The principal complications of jejunostomy performed for enteral nutrition can be classified as mechanical, gastrointestinal, metabolic and infectious.[2]

The mechanical complications include

1. Leak into peritoneal cavity
2. Tube dislodgement
3. Jejunal perforation
4. Entero-cutaneous fistula
5. Abscess-intra abdominal/ cutaneous
6. Small bowel gangrene
7. Tube block
8. Peritubal leak and
9. Tube detachment

The tube can migrate to the abdominal cavity and infuse nutrients into the peritoneal space. To avoid this complication, the technique must include affixing the jejunum to the parietal peritoneum at the site of the puncture. The presence of intestinal leakage through the puncture site is decreased if a subserous tunnel can be made at the point of enterotomy. In a large study, intestinal occlusion and volvulus occurred in 0.14% of all needle catheter jejunostomy procedures. Small bowel volvulus at the anchored site of jejunostomy tube can be prevented by broad-based fixation (6-10 cm) of the jejunal loop to the parietal

peritoneum of the anterior abdominal wall using three or four 3/0 silk sutures. Often, patients who receive enteral nutrition do not receive adequate amounts of free water. Unless fluid is restricted, most patients should flush their tubes frequently with a liberal amount of water (60 to 120 ml) and infuse additional free water to meet his/her daily fluid requirement. In case of tube block water is the best flush solution.[2]

The pathogenesis of ischemic necrosis secondary to enteral feeding is likely to be multifactorial including intraluminal factors such as hyperosmolarity of feeds and intestinal bacterial overgrowth. The absorption of intraluminal nutrients increases energy demands in metabolically stressed enterocytes, therefore putting the intestine at risk for ischemia in patients with systemic hypoperfusion. Bacterial overgrowth is likely to occur, especially when enteral feeding is administered for prolonged periods in the setting of ileus or in patients who are receiving H_2 receptor blockers or proton pump inhibitors. Increasing concentrations of luminal toxins derived from the overgrowth of bacteria could cause a mucosal-submucosal inflammatory response. This coupled with intraluminal gas production from substrate fermentation, could set up a vicious cycle of inflammation, distention, and dysmotility that eventually may impair mucosal perfusion resulting in ischemic injury. Early signs of this syndrome are very nonspecific. Distension is a nonspecific finding and should prompt decrease in the rate of tube feeding and close monitoring. A worsening general

condition or sepsis mandates early operative intervention with resection of ischemic bowel as the only way to decrease morbidity and mortality.[8]

The causative mechanism of small-bowel perforation remains unclear. Hyperosmolarity, invasive bacterial overgrowth and massive bolus impaction are implicated for direct mucosal injury which lead to intense local vasospasm; this in turn could cause ischemic necrosis and perforation.[9]

The gastrointestinal complications include

1. Abdominal distension / colic
2. Diarrhoea
3. Constipation
4. Nausea and vomiting

Abdominal distension and colic are secondary to alterations in intestinal motility, intestinal obstruction and fecal impaction. Constipation is commonly secondary to dehydration and lack of dietary fiber. Diarrhoea can be due to multiple causes which include lactase deficiency, malabsorption of fats, hypoalbuminemia, medications (H2-blockers, proton pump inhibitors, antacids, chemotherapy, laxatives, and antibiotics), high osmolarity and bacterial contamination of the formula or the infusion tubes.[2]

The metabolic complications include

1. Hypokalemia
2. Hypo or hyperglycemia
3. Hypercalcemia
4. Hypophosphatemia and
5. Hypomagnesemia

Metabolic complications are usually secondary to inadequate selection of the nutrients and poor infusion technique.[2]

The infectious complications include

1. Aspiration pneumonia and
2. Contamination of the diet

Inappropriate placement of the jejunostomy tube permits migration of the tube to the stomach leading to aspiration. Other possibilities are that the patient might have a hiatus hernia, gastroesophageal reflux or delayed gastric emptying. Enteral diets are a rich culture medium and can be contaminated by Enterobacter, Escherichia coli, Klebsiella, Proteus, Salmonella enteritidis, Pseudomonas aeruginosa, Staphylococcus aureus and Staphylococcus epidermidis. This occurs during preparation of feeds. To minimise the incidence of reflux it is useful to use infusion pumps to pass the nutrients and to use a closed infusion system, which should be changed every 24 hours.[2]

Although feeding jejunostomy has its complications most of the complications are minor. Blocked tubes and minor gastrointestinal symptoms are the main complications. It is a safe and cheap method of feeding patients in a country like India where cost is a major factor. Feeding jejunostomy is a simple way of administering enteral nutrition especially after oesophago-gastric and hepatobiliary pancreatic operations because

(i) Patients undergoing upper gastro-intestinal operations are frequently malnourished

(ii) They may develop complications that delay onset of oral intake

(iii) The jejunostomy tubes are inserted under direct vision downstream to the most distal anastomosis and can be firmly secured in position and

(iv) They are not susceptible to being displaced by postoperative vomiting or retching.

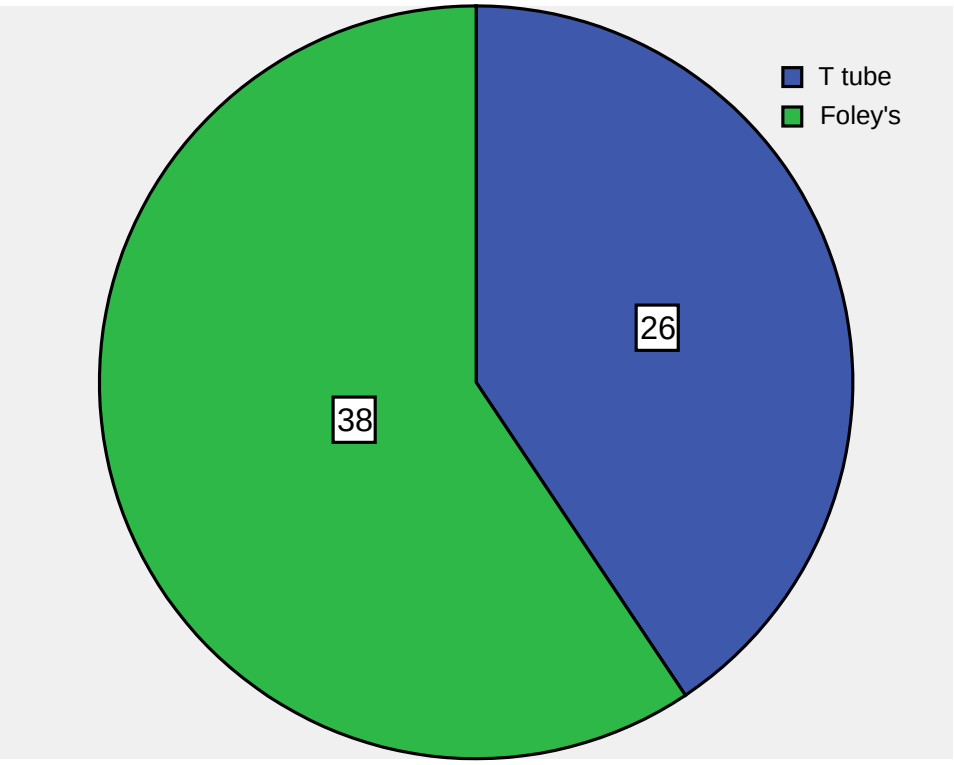
The‘t’ tube technique is an effective and rapid technique for placement of a feeding tube with comparatively low complication rate. The use of soft latex t-tubes reduces the risk of intestinal perforation by the jejunostomy tube. Latex t-tubes are not only inexpensive, but they also encourage the early formation of a fistulous tract permitting safe replacement in the event of dislodgement. Also, the large calibre of the tube minimises the risk of tube obstruction by feeds or tube-administered medications.[1]

RESULTS

A total of 64 patients were recruited for the study. Of these 26 were in the T-tube arm and 38 were in the Foley's catheter arm.

Figure No.2

Distribution of patients by type of jejunostomy



There was a male preponderance in both groups (Figure 3). The above features and the diagnosis (Figure 6), whether performed by a senior surgeon or trainee (Figure 5), whether elective or emergency (Figure 4) is summarized in Table 1.

Table No. 1

Characteristics of patients who underwent feeding jejunostomy by type of jejunostomy

	T- tube No.6 (n = 26)	Foley's No.18 (n = 38)
Age in years : Median(Range)	44(17-60)	44(21-80)
Gender: Number of men (%)	19(73)	30(78)
Diagnosis: Periampullary carcinoma	9	12
Ca head of pancreas	1	4
Pancreatitis	3	9
Acute abdomen	4	5
Upper GI bleed	1	1
Cholangio carcinoma	0	2
Choledochal cyst	4	0
Others	4	5
Elective cases (%)	21(80)	32(84)
Emergency cases (%)	5(20)	6(16)
Surgery performed by senior surgeons (%)	23(88)	35(92)

Acute abdomen included patients with hollow viscus perforation and blunt injury abdomen. Others included cases of carcinoma stomach, gall bladder malignancy and common bile duct stricture.

Figure No.3

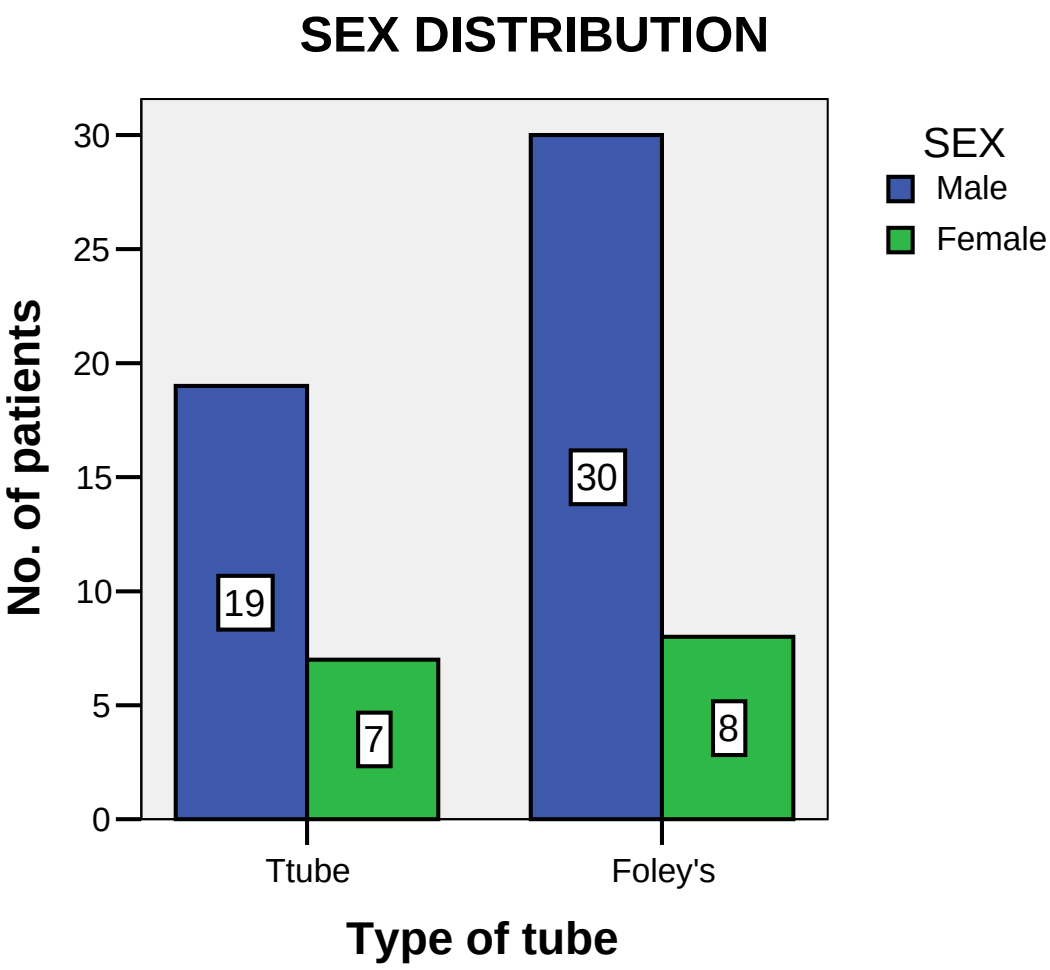

SEX DISTRIBUTION
No. of patients
30
25
20
15
10
5
0
19
7
30
8
Ttube
Foley's
Type of tube
SEX
Male
Female

Figure No.4

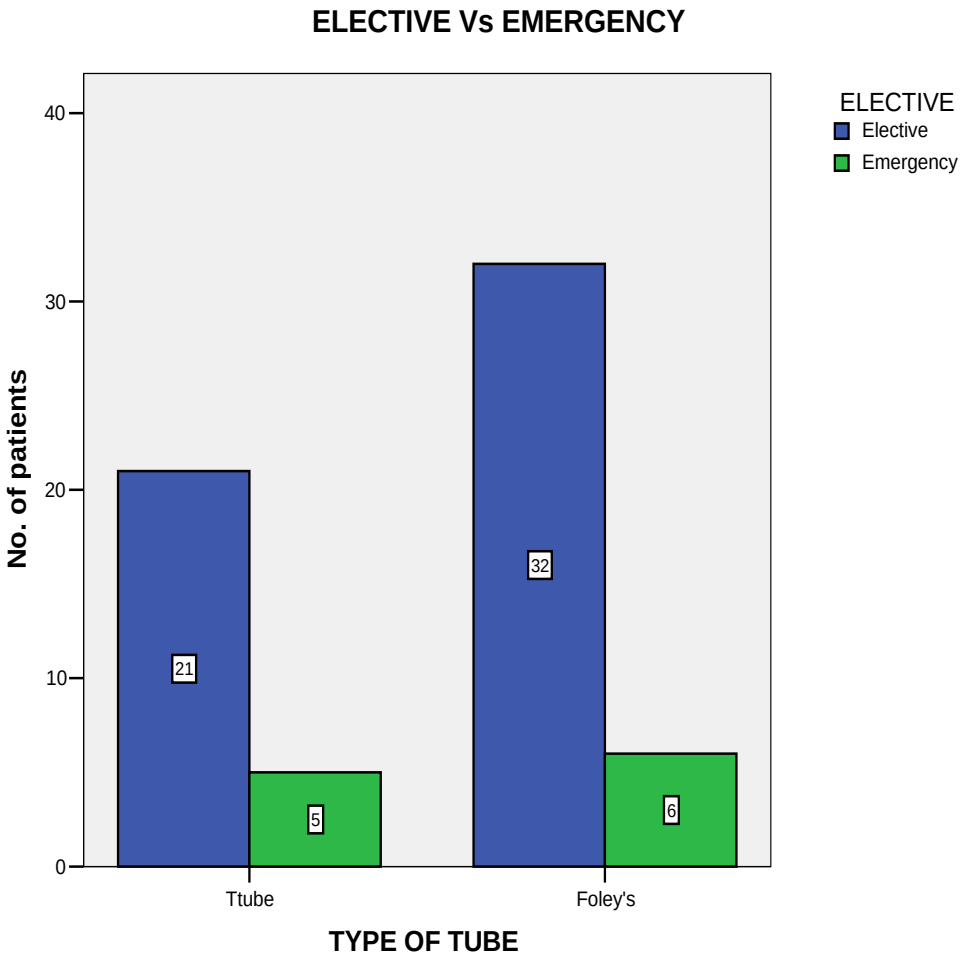

ELECTIVE Vs EMERGENCY
No. of patients
40
30
20
10
0
21
5
32
6
Ttube
Foley's
TYPE OF TUBE
ELECTIVE
Elective
Emergency

Figure No.5

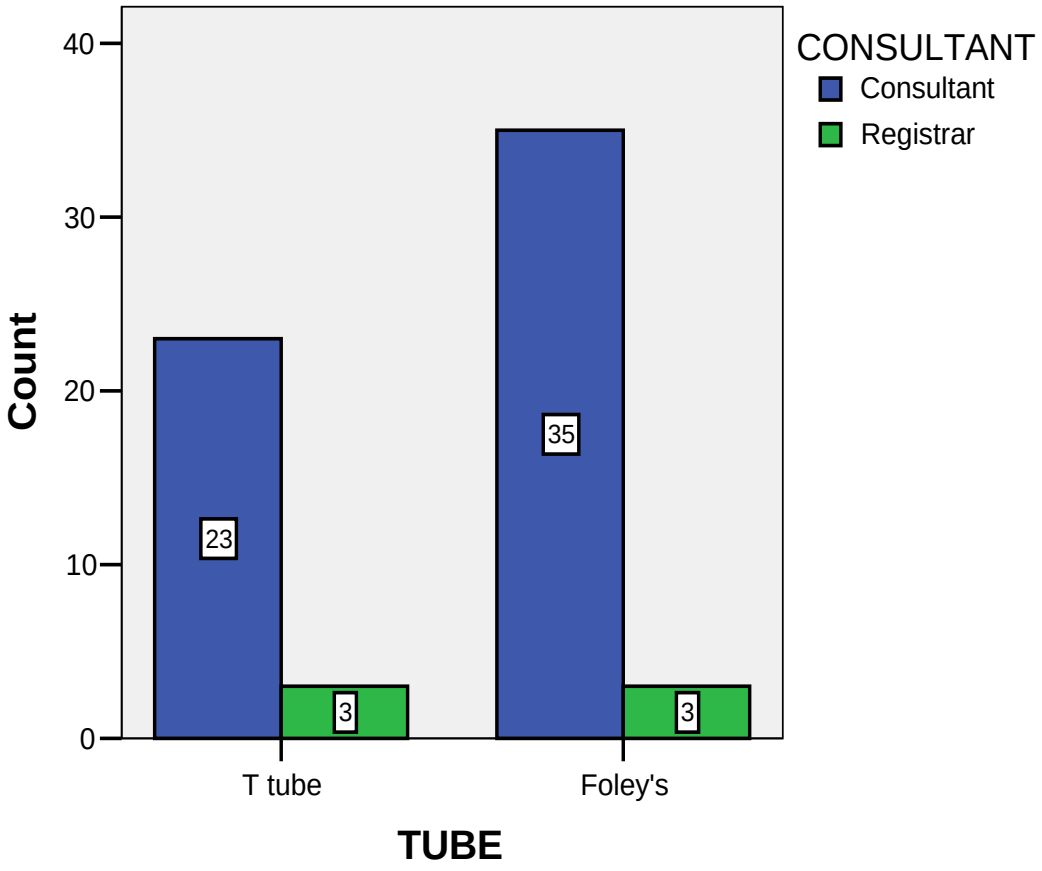
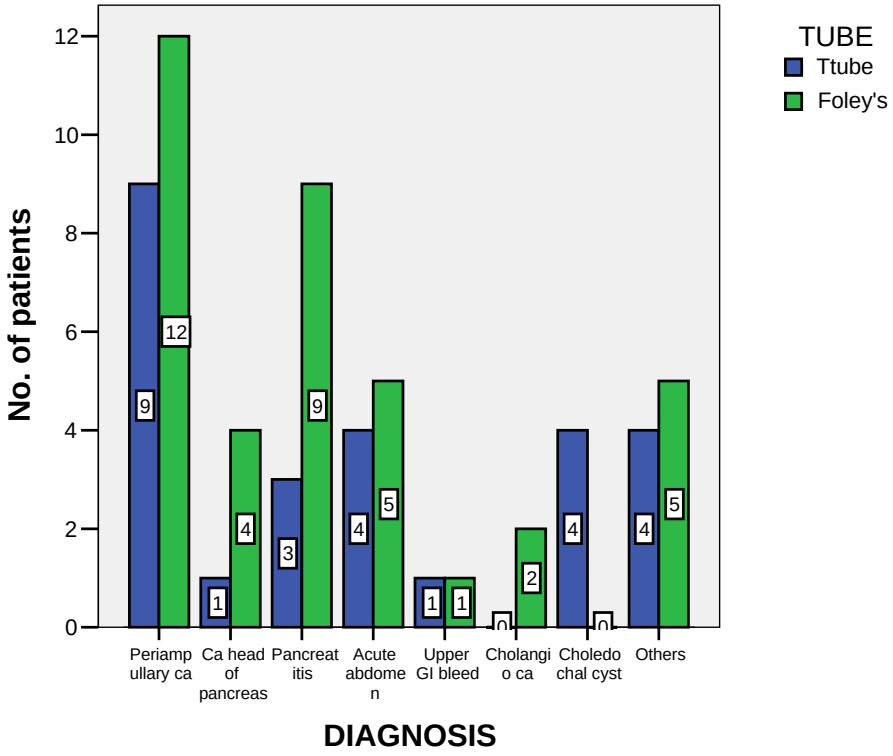

CONSULTANT
Consultant
Registrar
Count
40
30
20
10
0
23
3
35
3
T tube
Foley's
TUBE

Figure No.6


TUBE
Ttube
Foley's
No. of patients
12
10
8
6
4
2
0
9
12
1
4
3
9
4
5
1
1
0
2
4
0
4
5
Periamp ullary ca
Ca head of pancreas
Pancreat itis
Acute abdome n
Upper GI bleed
Cholangi o ca
Choledo chal cyst
Others
DIAGNOSIS

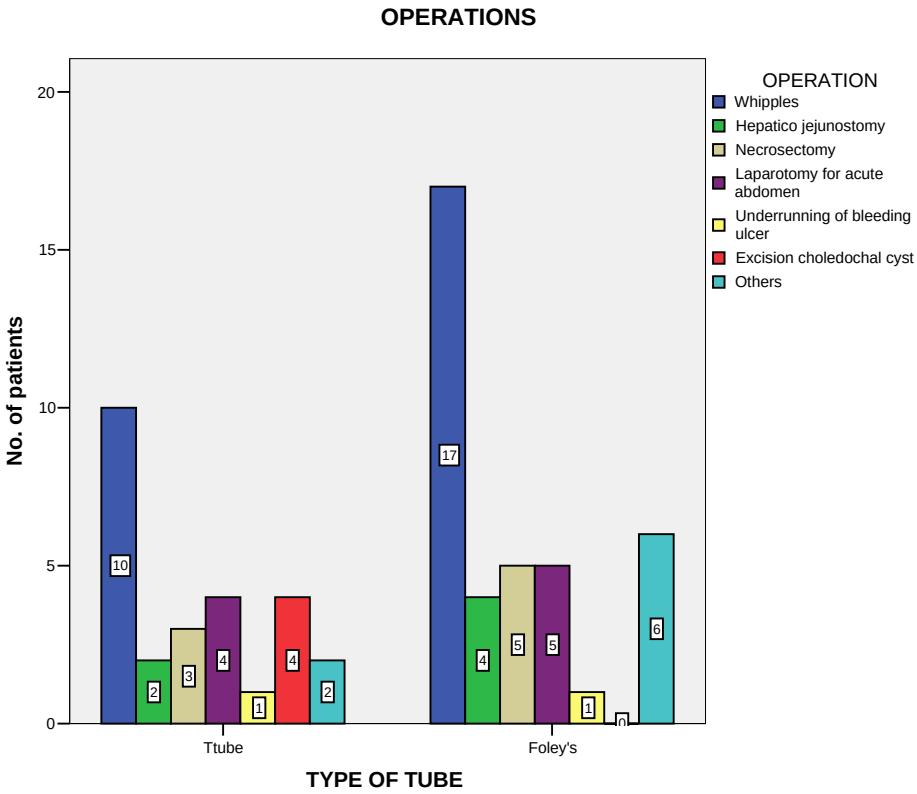
The distribution of operation performed in either group was as follows:

Table No.2

Distribution of nature of operations

	T – tube No.6 (n=26)	**Foley's No.18** (n=38)
Whipple's	10	17
Hepatico jejunostomy	2	4
Necrosectomy	3	5
Laparotomy for acute abdomen	4	5
Under running of bleeding ulcer	1	1
Excision choledochal cyst	4	0
Others	2	6

Figure No.7


OPERATIONS
No. of patients
20
15
10
5
0
10
2
3
4
1
4
2
17
4
5
5
1
0
6
Ttube
Foley's
TYPE OF TUBE
OPERATION
Whipples
Hepatico jejunostomy
Necrosectomy
Laparotomy for acute abdomen
Underrunning of bleeding ulcer
Excision choledochal cyst
Others

The patients were followed up for the duration of their hospital stay. The range of complications seen is shown in Table 3.

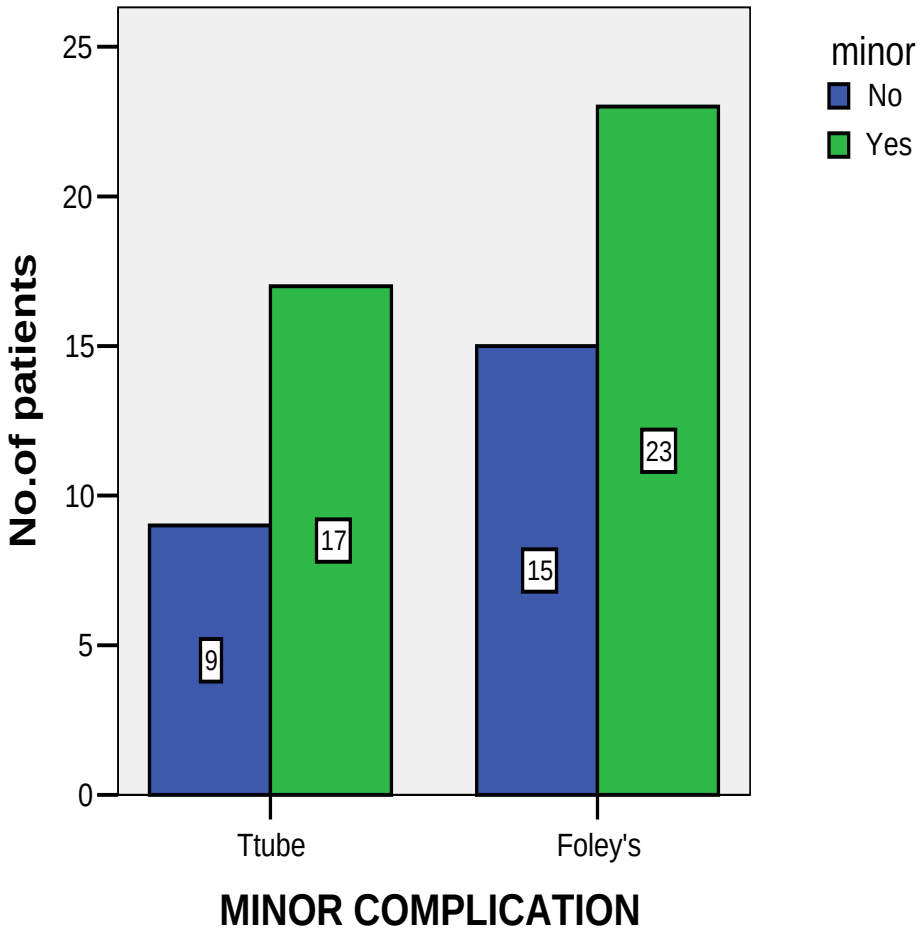
Table No.3

Frequencies of complications during follow up by type of jejunostomy

	T- tube No.6 (n = 26)	Foley's No.18 (n = 38)
Follow up in days (mean)	21	19
Major complication Leak into peritoneal cavity	1	0
Tube dislodgement	1	1
Enterocutaneous fistula	0	1
Intra abdominal abscess	1	1
Small bowel gangrene	0	1
Proximal loop obstruction	1	0
Minor complication Tube block	10	8
Tube detachment	1	1
Peritubal leak	14	15
Diarrhoea	1	3
Mortality*	1	2

* related to feeding jejunostomy placement

Figure No.8


minor
No
Yes
No.of patients
25
20
15
10
5
0
9
17
15
23
Ttube
Foley's
MINOR COMPLICATION

Two patients had tube dislodgement one each in t –tube and Foley's group respectively. In both situations it was possible to reintroduce Foley's catheter no 18 without any difficulty and the position of the tube was confirmed under fluoroscopy before commencing feeds.

One patient who underwent laparotomy for duodenal ulcer perforation developed small bowel gangrene. This patient was on high doses of inotropes for a prolonged period of time in the intensive care unit in the immediate post operative period. He made reasonable progress and was transferred to the ward. There he developed feculent discharge from the wound and was re-explored with a diagnosis of reperforation. At the second operation he was found to have multiple areas of patchy small bowel gangrene with a perforation in one such area. It is not clear whether the increased amount of inotropes was the cause of small bowel gangrene. He subsequently died due to multi organ failure.

One patient in the t-tube group developed proximal loop obstruction due to acute angulation of jejunal loop at the anchored site of jejunostomy tube which needed re-exploration and revision of feeding jejunostomy using a Foley's catheter.

Another patient in the t – tube group who underwent Whipple's procedure for periampullary carcinoma developed intraabdominal collection due to leak from the jejunostomy site. He underwent re-

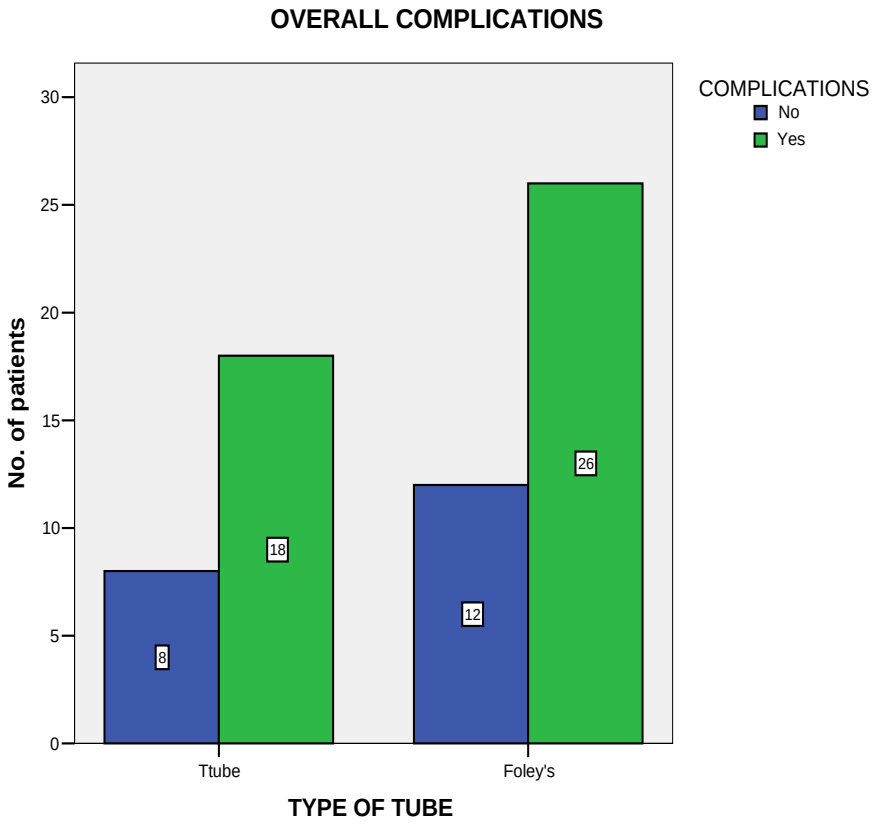
exploration and revision of feeding jejunostomy using a Foley's catheter. He subsequently died due to sepsis.

One patient in the Foley's group who underwent triple bypass for inoperable periampullary carcinoma developed enterocutaneous fistula from the feeding jejunostomy site. He died due to sepsis and electrolyte disturbances.

Table No.4
Occurrences of complications during follow up according to type of feeding jejunostomy

	T- tube No.6 (n = 26)	Foley's No.18 (n = 38)	Statistical significance
Major complication (%)	4 (15)	4 (10)	Chi square test p =0.612
Minor complication (%)	17(65)	23(60)	Chi square test p=0.4449
Any complication (%)	18(69)	26(68)	Chi square test p=0.584

Figure No.9


OVERALL COMPLICATIONS
COMPLICATIONS
No
Yes
No. of patients
30
25
20
15
10
5
0
8
18
12
26
Ttube
Foley's
TYPE OF TUBE

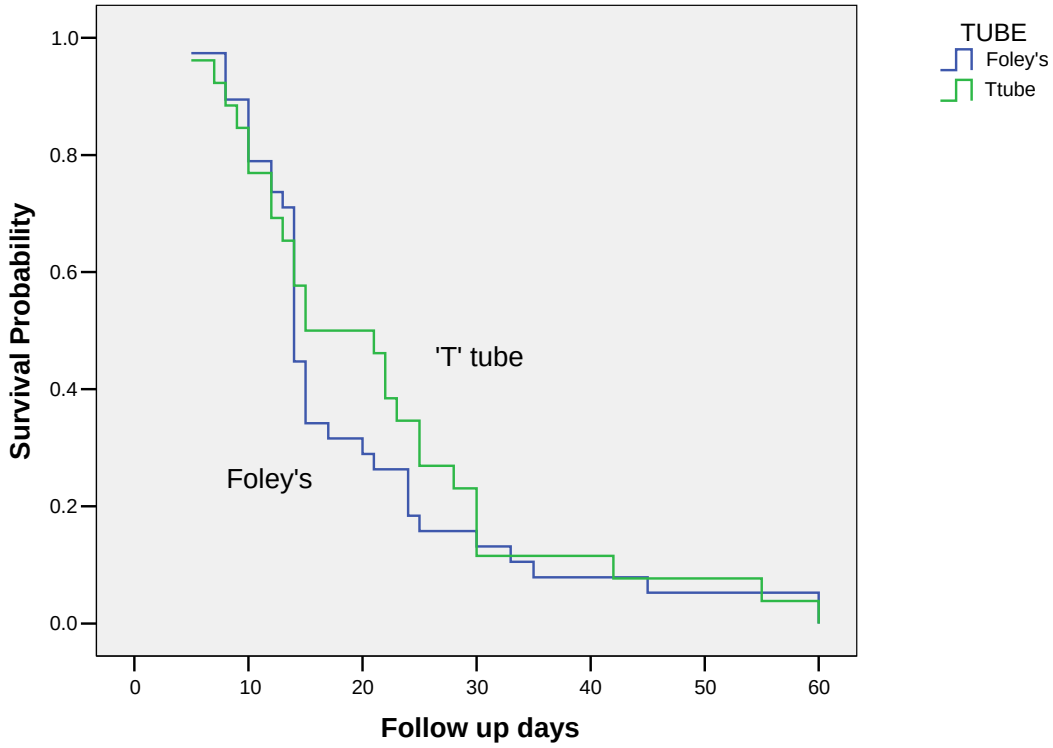
The average time taken to do a t-tube feeding jejunostomy was lower than that for Foley feeding jejunostomy (Table 5).

Table No.5

Time required for performing jejunostomy according to the type of jejunostomy

	T- tube No.6	Foley's No.18
Time required for jejunostomy(minutes)	6	10

Kaplan-Meier survival curve for occurrence of any complications for patients fed by t-tube or Foley' jejunostomy,



There was no significance difference between the two groups with respect to occurrence of complications.

DISCUSSION

The results of this prospective, non randomised study show that t-tube feeding jejunostomy is as effective as Foley's feeding jejunostomy. The complication rates are comparable. Moreover t-tube jejunostomy is a simple procedure and can be done fairly quickly (6 minutes) as compared to Foley's jejunostomy (10 minutes).

Patients in both study groups were comparable in terms of age, gender, diagnosis and duration of follow up. There were a significantly large number of males in both groups. Most of the operations were elective operations and were performed by senior consultants.

The most common indication for feeding jejunostomy was as an additional procedure to supplement nutrition during the recovery phase of major operations of upper gastro intestinal tract including operations of liver, biliary tract and pancreas as quoted by Jesus Tapia et al.[2]

Feeding through a jejunostomy is not without risk. Earlier studies done by Paul A. Thodiyil[1] and Jesus Tapia[2] have reported intestinal obstruction, development of pneumatosis intestinalis, small bowel gangrene, jejunal perforation and intra-abdominal leakage of enteral feeding due to tube dislodgement. The incidence of major

complications in our study is 15% and 10% for t-tube and Foley's group respectively as shown in Table no. 3.

Two patients had tube dislodgement one each in t–tube and Foley's group respectively. In both situations it was possible to reintroduce Foley's catheter no 18 without any difficulty and the position of the tube was confirmed under fluoroscopy before commencing feeds. In keeping with previous studies as shown by Paul A. Thodiyil, t-tubes do encourage the early formation of a fistulous tract permitting safe replacement in the event of tube dislodgement.[1]

There was no case of pneumatosis intestinalis in the study group. One patient developed gangrene of the small bowel and it is not clear whether the increased amount of inotropes required in the post operative period was the cause of small bowel gangrene.[8]

One patient in the t-tube group developed proximal loop obstruction due to acute angulation of small bowel at the anchored site of jejunostomy tube which needed re-exploration and revision of feeding jejunostomy using a Foley's catheter. Acute angulation and small bowel volvulus at the anchored site of jejunostomy tube can be prevented by broad-based fixation (6-10 cm) of the jejunal loop to the parietal peritoneum of the anterior abdominal wall using three or four 3/0 silk sutures.[21]

One patient in the t-tube group who underwent Whipple's procedure for periampullary carcinoma developed intraabdominal collection due to leak from the jejunostomy site. He underwent re- exploration and revision of feeding jejunostomy using a foley's catheter. The presence of intestinal leakage through the puncture site can be decreased if a subserous tunnel is be made at the point of enterotomy.[2]

Minor complications related to the feeding catheter were 65% and 60% for t–tube and Foley's group respectively. Although the complication rates were comparable to studies done earlier[1, 3] most of these complications were due to tube block and pericatheter leak. None of these required surgical intervention but were managed by simple measures only. Catheter blockage was managed successfully by flushing the catheter with water, sodium bicarbonate solution or a fizzy drink using a 20 ml syringe. One Foley's catheter had to be changed and it was possible to reinsert a new 18Fr Foley's catheter without the need for fluoroscopic guidance. Diarrhoea related to the feeds was managed by change of feeding regimen, decrease in the strength of feeds or change of infusion rate.

Although not statistically significant the major complication rates in the t-tube group were slightly higher in our study as compared to that reported by Paul A. Thodiyil.[1] Given the non-randomised nature of the study and the relatively small sample size, the question of whether t-tube feeding jejunostomy is associated with increased rate of major

complications could not be answered. Further large, randomised, trials will be required to resolve this issue.

Overall the complication rates between the two groups were not statistically significant whether it was the consultant or registrar performing the operation, using either the t–tube or Foley's in both elective and emergency circumstances. Moreover t-tube jejunostomy is a simple and quicker procedure.

CONCLUSIONS

From this study, it can be concluded that

- T-tube jejunostomy is as effective as Foley's jejunostomy
- The complication rates between the 2 groups are comparable
- T- tube procedure is a simple and relatively quick procedure.
- T- tube encourage the early formation of a fistulous tract permitting safe replacement in the event of tube dislodgement

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LIMITATIONS

- Many patients belonging to General Surgery Unit III (Oesophago Gastric Surgery) could not be enrolled in the study as they had omentectomy as part of the operation. This contributed to the small sample size of this study.

- The study had to be truncated early because one of the senior consultants refused to do t-tube jejunostomy after one of his patients died due to complication related to the t-tube jejunostomy.

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ANNEXURE I

PROFORMA

NAME: AGE: SEX:
NO:

Hospital No Consultant/Registrar

Diagnosis

Operation Done

Tube used Time

Period of follow up Elective/Emergency

Complication Yes No

MAJOR		**MINOR**	
Leak into peritoneal cavity		Tube block	
Tube dislodgement		Tube detachment	
Jejunal perforation		Peritubal leak	
Entero cutaneous fistula		Diarrhoea	
Abscess – cutaneous / intra abdominal			

Others

Mortality

ANNEXURE II MASTER SHEET